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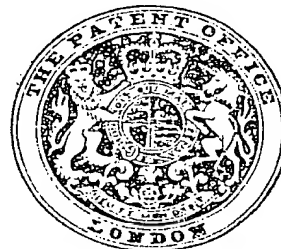
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## (54) SURFACE COVERING MATERIAL

(71) We, NIPPON ASBESTOS CO. LTD., a Japanese company, of 12-9 Shibakoen Daigogo-chi, Minato-Ku, Tokyo, Japan; do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to the production of surface covering materials, and more particularly to the manufacture of surface covering materials having a relief pattern or design.

Heretofore, in general, the surface covering materials such as, for example, floor coverings, having a relief pattern have been manufactured by making use of a metal mould, on which a desired pattern is engraved, etched, or cast to form lands and valleys in conformity with the relief pattern of the final product. Plaster is then poured and cast in the mould.

Techniques for preparing the relief pattern of the surface of the metal mould are very troublesome, and involve considerable time and expense.

Furthermore, certain techniques are already known for preparing a product of the general kind herein described having a printed or relief pattern without employing such mould.

According to one of such prior operations, a desired pattern is painted with adhesives on the surface covering material and fine particles such as sands are applied to the surface covering material for bringing the painted pattern into relief.

However, the products made by such prior operation are of unattractive appearance and are troublesome to manufacture.

It is an object of the present invention to provide an improved method for making surface covering materials by means of a mould or die made from a photosensitive, curable plastics material.

It is another object of the present invention to provide a surface covering material,

such as a decorative wall panel having thereon a pattern or design in relief which is attractive in appearance, and inexpensive to manufacture. The relief pattern may be coloured.

According to the invention, there is provided a method for making a surface covering material having a relief pattern thereon, which comprises (a) forming a matrix mould or die having a desired relief pattern by exposing a photosensitive, curable plastics material to light through an image of the pattern to cause the exposed portions of the plastics material to become cured, and removing unexposed, uncured portions of the plastics material by washing thereby to form the matrix mould or die with the relief pattern; and (b) casting or pressure-moulding into the matrix die or mould a curable mouldable material so as to impress the relief pattern on the surface of said mouldable material, followed by curing of the mouldable material.

In the present invention, the mould is made of one or more photosensitive, curable plastics materials which are well-known in the art. Examples of such photosensitive, curable plastics materials include a mixture of an unsaturated polyester resin and a vinyl monomer, a mixture of a vinyl compound and an acrylic compound, amide resin, a mixture of a cellulose derivative and an acrylic compound, urethane resin, and a mixture of such compositions.

The pattern to be present in relief on the surface of the final product may be developed on a photographic negative film as the image of the pattern by the conventional photographic processes. Alternatively, the desired pattern may be directly printed or painted on a transparent film or plate by conventional techniques. The negative with the image of the pattern is placed on a base or substrate of the photosensitive, curable plastics material to which the pattern is imparted by exposure through the negative to light having a wavelength of 300—400 mμ.

so hardening the parts of the base which are exposed. The exposed base or substrate is then developed, that is, it is washed with water, alcohol or solution of caustic soda in water so as to wash away the portions which have not been cured by the action of light to leave those portions of the base or substrate which have become insoluble by exposure to light. The substrate thus developed is used as a mould according to the present invention.

The curable, mouldable material from which the surface covering material is moulded or cast in the mould or die advantageously comprises a fibrous substance, for example asbestos or glass fibres. The curable mouldable material may, for example, be a mineral mix, plaster or a cementitious mix.

The invention is further illustrated by way of example, in the accompanying drawings in which:—

Figure 1 is a diagrammatic sectional view illustrating the manner of preparing a mould; and

Figures 2 to 5 are diagrammatic illustrations of apparatus for making surface covering material having a desired relief pattern.

In the drawings, Figure 1, illustrates the manner of preparing a mould or die designated by the reference numeral 10. A sheet of polyester 12 is placed on a glass plate 11. It is preferred to apply adhesives, such as urethane liquid or epoxide fluid, on the upper surface of the sheet 12 as the adhesive layer 13. Frame or rim members 14 for defining the periphery of the mould are placed on the sheet 12 in a desired shape, and then a photosensitive, curable plastics material 15 is poured into the space within the frame members 14 and another polyester sheet 16 is placed on the plastics material within the frame members. A photographic negative film 17, upon which the desired pattern has been printed, is placed on the sheet 16, and a transparent glass plate 18 is placed on the film 17.

The plastics material 15 is then exposed, through the film 17, to light having a wavelength of about 300—400 m $\mu$  from a suitable source such as a high voltage mercury-arc lamp or ultraviolet fluorescent lamp (not shown). The light incident on transparent portions 17b of the film 17 passes substantially wholly through the film into the underlying plastics material 15 and the portions 15a of the plastics material which have been thus exposed to the light are cured or hardened. The light incident on dense black portions 17c of the image on the film 17 is wholly intercepted and thus prevented from reaching the underlying plastics material 15, and the portions 15b of the plastics material which have not been exposed to the light remain uncured. The light incident on dark but translucent portions 17a of the image

on the film 17 is only partially intercepted, the remainder of the light passing through to the underlying plastics material 15. The depth to which the plastics material 15 underlying a translucent portion 17a is cured will vary with the amount of light which is permitted to pass through and, consequently with the translucence of the portion 17a of the image. Thus the relief forming pattern of the image on the film 17 is provided by areas of different transparencies.

The exposed plastics material 15 is then developed by washing with water, a solution of alkali in water or any other suitable solution depending on the properties of the plastics material used. The uncured portions 15b are thus removed, leaving only portions 15a.

When the sheet of cured plastics material is used as the die or mould, the frame members 14 are removed. In the production of the surface covering material having the relief pattern in accordance with the present invention, it will be understood that the relief pattern of the mould is imparted to the surface of the plaster cast, or pressure-moulded therein.

The reinforcing polyester sheet 12 and the layer of plastics material 15 may be such that the mould or die 10 produced from such a combination generally has sufficient flexibility to permit it to be secured (for example by means of an adhesive) on the surface of a roll, as illustrated on roll 23 in Figures 2 and roll 57 in Figure 5.

The invention is further illustrated in the following examples:

#### EXAMPLE 1

Referring to Figure 2, a slurry 21 of asbestos, cement, diatomaceous earth and calcium hydroxide prepared by kneading the same with water is continuously fed by a conveyor 22 between a roll 23, around which the forming die 10 having the relief pattern is mounted, and a roll 25 so as to impress the relief pattern of the die 10 to the uncured slurry material 21. The material is then dried and cured, after which it is cut to the desired size as the final product.

#### EXAMPLE 2

Referring to Figure 3, blocks of uncured material 31 have been prepared from rock wool, starch, urea resin, or clay by kneading the same with water. The block 31 is introduced by a conveyor 32 between a forming plate 33 carrying the die 10 having the relief pattern and a base plate 34. The block 31 of uncured material is pressure-moulded between the forming plate 33 and the base plate 34. The valleys and lands of the die 10 on the forming plate 33 are stamped on the surface of the block 31.

#### EXAMPLE 3

Referring to Figure 4, a slurry 41 of a curable material comprising gypsum, glass

fibres, pulp, mineral mix, plaster or a cementitious mix prepared by kneading the same with water is poured into a casing 42 in which the mould or die 10 is contained. After drying and curing the cast slurry, it is taken out of the casing.

#### EXAMPLE 4

Referring to Figure 5, asbestos, Portland cement, fine granulated quartz are mixed with a large quantity of water to make a slurry 51. The slurry 51 is fed into a vessel 52 in which a cylindrical drum 53 of wire net is rotatably mounted. On rotating the drum 53, the water in the slurry enters into the drum, and the plaster material is captured or retained by the surface of the drum 53 to be separated from water and taken out of the vessel. The material is then transferred to a blanket or conveyor 54 which runs over a catch roller 55 arranged in rolling contact with the drum 53 and over a roll 58. At the time of the transfer, the material is compressed on the blanket or conveyor 54 by the cylindrical drum 53 and the catch roller 55 to be formed into a thin layer 56. The layer 56 is continuously wound up in the form of a lamination on a roll 57 around which is fitted the forming die 10 having the relief pattern. The inner surface of the laminated material wound round roll 57 and facing the relief pattern of the forming die is pressed by the roll 58 against the relief pattern of the die 10. When the lamination has attained a desired thickness, the lamination wound on the roller 57 is cut into appropriate lengths by a suitable cutter (not shown) and removed from the roller 57 by a conveyor 59 as the surface covering material.

According to the method of this example, the relief forming is not carried out on a thick layer of the material but on a thin layer, after which lamination to a desired thickness is effected so that even material containing fibrous substances, such as asbestos, may be relief-formed clearly.

The relief-patterned product thus obtained may be coated with paint and then the lands of the product may be coloured by a roller coating process.

#### WHAT WE CLAIM IS:—

1. A method for making a surface covering material having a relief pattern thereon, which comprises (a) forming a matrix mould or die having a desired relief pattern by exposing a photo-sensitive, curable plastics material to light through an image of the pattern to cause the exposed portions of the plastics material to become cured, and removing unexposed, uncured portions of the plastics material by washing thereby to form the matrix mould or die with the relief pattern; and (b) casting or pressure-moulding into the matrix die or mould a curable

mouldable material so as to impress the relief pattern on the surface of said mouldable material, followed by curing of the mouldable material.

2. A method according to claim 1, in which the photosensitive, curable plastics material is exposed to light whilst confined in a space defined (i) laterally by frame members, and (ii) by glass plates and a film on which the said image is provided, the said images being formed by areas of differing transparency.

3. A method according to claim 1 or claim 2, in which pressure-moulding of the mouldable material in the die is done by introducing the mouldable material between a pair of rollers, on one of which the die is fitted.

4. A method according to claim 1 or claim 2, in which pressure-moulding of the mouldable material is done by pressing the die mounted on a forming plate against one surface of a block of the mouldable material so as to stamp the relief pattern of the die on the mouldable material.

5. A method according to claim 1 or claim 2, in which the mouldable material is extracted from a liquid slurry thereof by means of a cylindrical drum or wire net to transfer the extracted mouldable material onto a blanket or conveyor moving over a plurality of rollers, one of which rollers is in contact with the cylindrical wire net drum, the mouldable material is carried to a take-up roll around which the die having the relief pattern is fitted, the mouldable material is pressure-moulded on said die by being pressed into contact with said take-up roll by one of said plurality of rollers carrying the blanket or conveyor, and the pressure-moulded material is cut to a required size of the final product.

6. A method according to claim 1 or claim 2, in which the mouldable material is cast in the mould having the relief pattern, and is removed from the mould after it has been cured.

7. A method for the production of a cured, surface covering material having a relief pattern thereon, substantially as hereinbefore described with reference to Figure 1 in conjunction with any one of Figures 2 to 5.

8. A method for the production of a cured, surface covering material having a relief pattern thereon, substantially as hereinbefore described with reference to any one of the Examples.

9. A surface covering material whenever produced by the method claimed in any one of the preceding claims.

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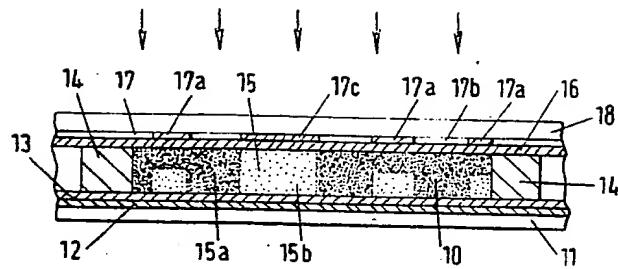


FIG. 1.

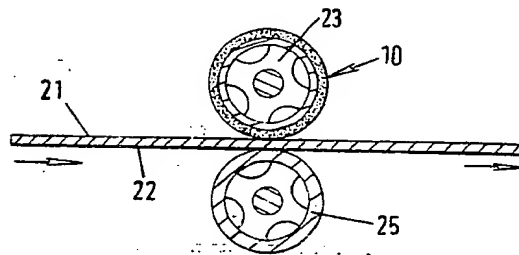


FIG. 2.

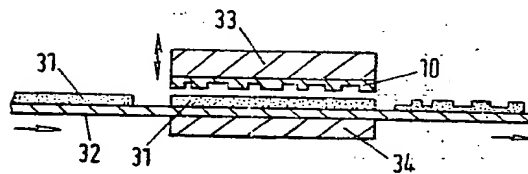


FIG. 3.

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COMPLETE SPECIFICATION

2 SHEETS

*This drawing is a reproduction of  
the Original on a reduced scale*

Sheet 2

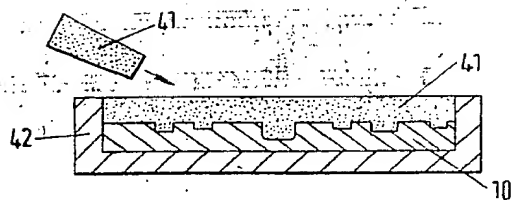


FIG. 4

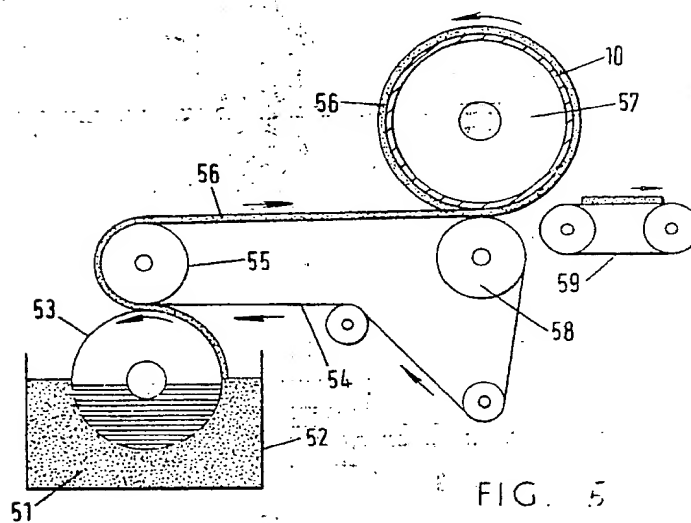


FIG. 5



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